LPAC-TV WEATHER REPORT

Vanishing Sunspots: A Window Into the Creative Universe

by Peter Martinson

LPAC-TV

Peter Martinson, the "Weatherman" for LPAC-TV, explains how the chemical composition of the Sun's corona is analyzed by modern imaging techniques—expanding the realm of human sense perception.

Good morning. I'm Peter Martinson. It's Aug. 24, 2011, and you're watching the LaRouchePAC Weather Report.[1]

Now, we're going to get right into the meaty material of this show. If you've been watching the LaRouchePAC website over the past couple of weeks, you should have recognized that we've been asserting—along with all the other great thinkers of the past—that the universe is not a dead universe. It is creative, inherently.

In fact, the substance of the universe is *mind*. And we know this by looking at how the human mind discovers a principle and how society then uses that discovery to increase mankind's power over the universe. The universe presents itself to us in the form of sense-perceptions, like vision, sound, or if you live up on Capitol Hill, you get a good sense of smell.

But the universe presents itself to us like this. We construct new sense-perceptions in the form of scientific instruments, like telescopes and things like that, in order to reveal

1. This program can be viewed at http://www. larouchepac.com/node/19172?page=5&lid=0-0-2&relation=60

more of the universe. But we understand that each of those sense-perceptions is only presenting a cross-section of the universe. If you took all the sense-perceptions and assembled them all into one big lump, you would not get the real universe.

A human takes a few of those sense-perceptions, combines them, and compares how the universe presents itself differently in different sense-perceptions, and then uses his imagination to discover what un-sensible prinicple has to be generating those paradoxes among the senses. Hence, the substance of the universe is represented by that discovery, not by the sense-perceptions generated by the universe's principles. Hence, the universe is composed of the creative mind.

Now, the goal of man is not to try to gather all the sense-perceptions, although we do naturally, as a human instinct, thirst for an ever-increasing menu of sense-perceptions, so that we have more cross-sections to play with and juxtapose, to get a better view of what we can discover about the universe.

But what we're going to look at in this show, is how heliophysicists and other astronomers have used this principle to discover principles of the activity on the Sun.

The Solar Spectrum

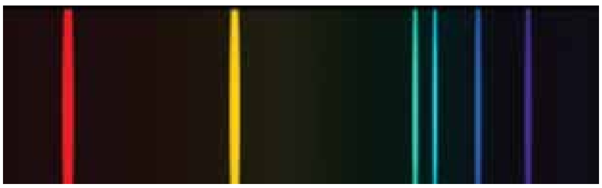
Since the 1900s, heliophycists and other astronomers have used what's called the spectrum, which is where you take light and you send it through a prism or some type of a beam-splitter, to split it up into its rainbow. Now, we have discovered that the rainbow is not just visible light, but it also goes into the infrared, which you can't see with your eyes. It also goes deep into the ultraviolent, X-ray, gamma ray, etc., which you can't see with your eyes, but we can pick it up with various instruments.

Now, what astronomers do, is pick out specific bands of the spectrum, and look at how these different bands represent themselves in the Sun and other astronomical objects. For example, this spectrum here (**Figure 1**) is the spectrum of hydrogen; this (**Figure 2**) is a spectrum of helium, both of which occur at the surface of the Sun.

FIGURE 1

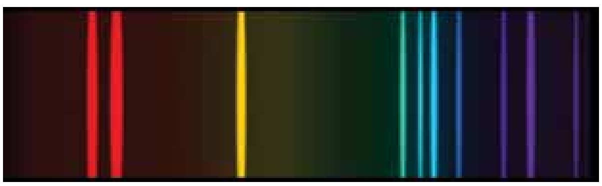
Hydrogen spectrum lines

FIGURE 2



Helium

FIGURE 3



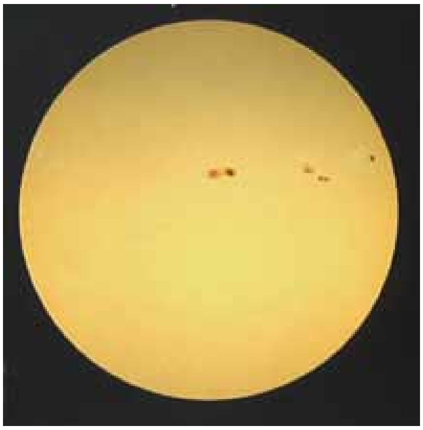
Several elements combined

And so, when you look at light from the Sun, and you split that up, you get something that looks more like this (**Figure 3**), where you have a variety of lines being created by a variety of chemicals and elements on the Sun. So, astronomers look at how they represent themselves on the surface of the Sun.

Now, this (**Figure 4**) is what you see if you look at the Sun through a telescope, with a filter—don't look at it with a regular telescope, because you'll go blind like Galileo did, so don't be stupid like Galileo. But this is what you see. It's essentially a yellow ball. Sometimes you'll see dark spots passing across the surface of it.

If we look at this in the infrared, we see a completely dif-

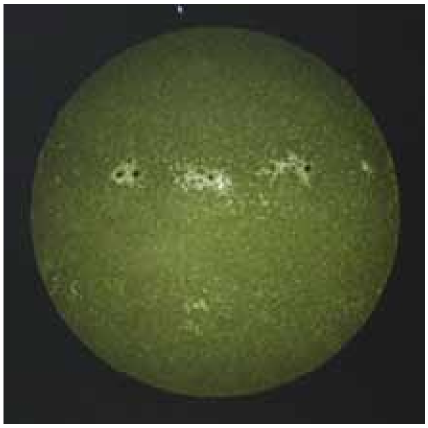
FIGURE 4



NASA Solar & Heliospheric Observatory

Visible light from the Sun

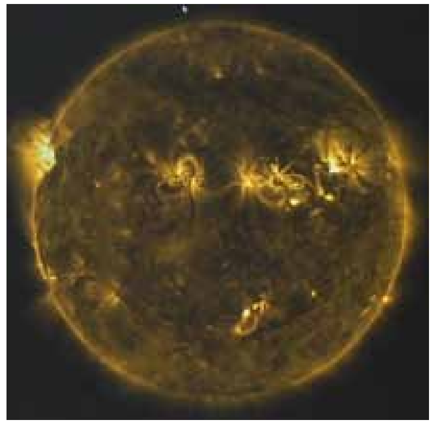
FIGURE 5



NASA Solar Dynamics Observatory

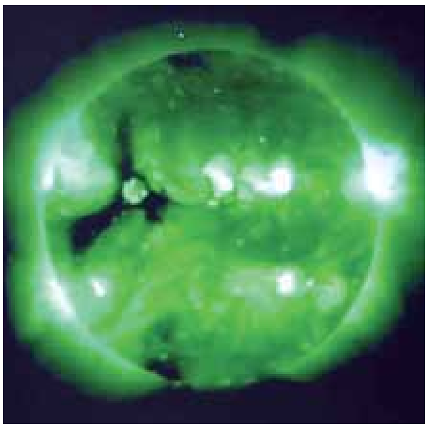
The Sun in the infrared spectrum: 1600 nm

FIGURE 6



The ultraviolet spectrum

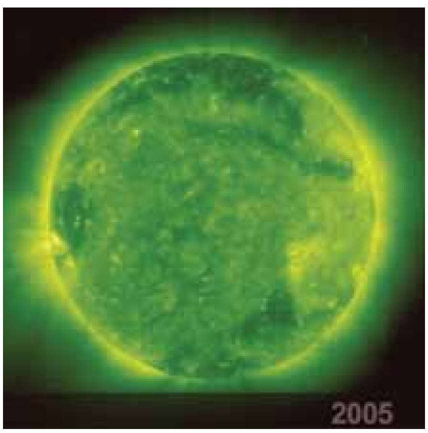
FIGURE 7



NASA-GOES

The X-ray spectrum

FIGURE 8



Cycle 23 in ultraviolet.

ferent creature (**Figure 5**). You see the surface looks finely granulated, and these things that we thought were featureless spots are actually crackling with very bright activity—the infrared.

Now, if you look at it in the ultraviolet (**Figure 6**), you see an even more interesting picture. These spots are flinging material out into space. This is a very violent, dynamic creature. It looks completely different. (And by the way, this is actually false color; it is colorized. It doesn't really look this color in the ultraviolet. We've made it this color so you can see the features.)

If you look at the Sun in X-rays (**Figure 7**), you see an even more violent picture, and you can see that the Sun is actually flinging material out into space, sometimes at us. Like last week, when it pumped out a so-called X7 flare, which is one of the most powerful events that we see happening on the Sun. It happens periodically.

So, what astronomers do is they take these images of the Sun, each of which looks like a completely different beastie, and combine them in various ways to make forecasts.

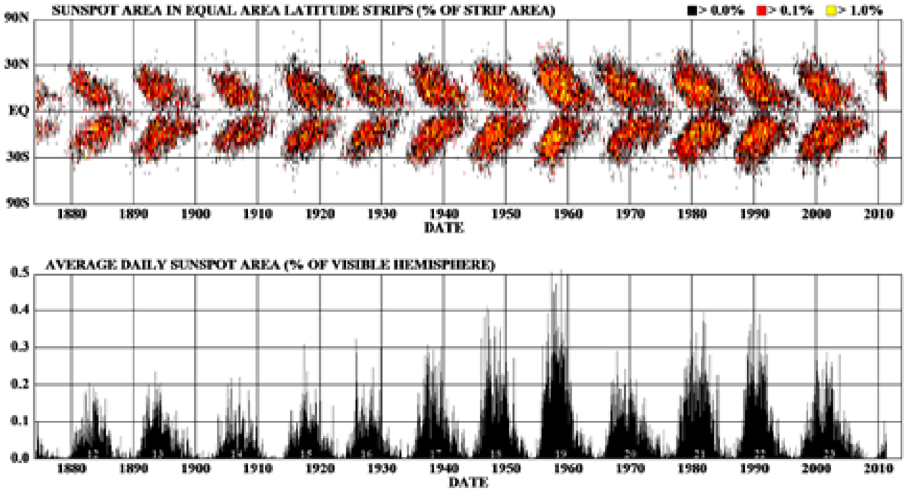
Now, one of the first observations that was made of the Sun was a count of the number of sunspots that pass over the surface, a very basic measurement. And what we found is that the Sun actually goes through a cycle of these things. Some of the time there are almost no sunspots, but then sometimes the Sun actually heats up and you get more and more sunspots.

This is an animation made by NASA of images from the SOHO space satellite (**Figure 8**), starting from about 1996, and going through 2008, which was the last so-called solar cycle, where you can see the Sun is getting more and more and more active with sunspots. If you look closely, you can see that the sunspots actually start at relatively high latitude and are migrating towards the Equator. Beautiful.

The Solar Minimum

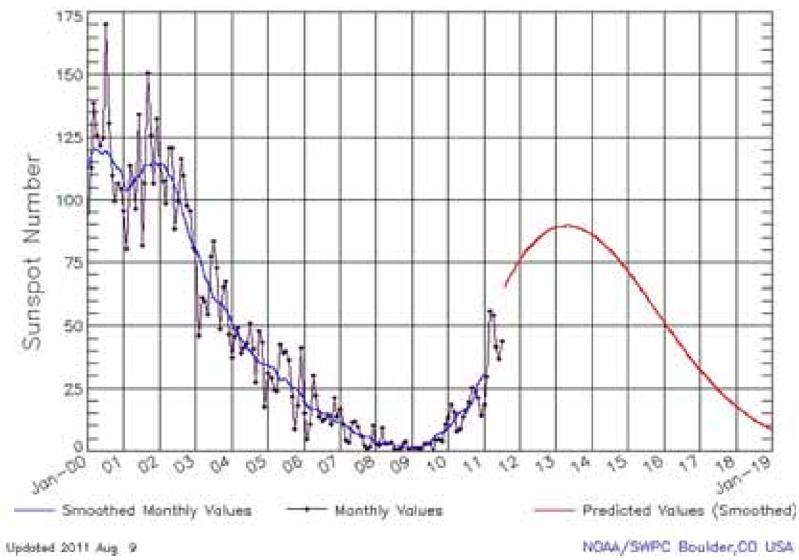
In 2008, the Sun went into its solar minimum. Now we're into the next solar cycle, so-called Cycle 24. Now, over a long time, people have been

FIGURE 9
Daily Sunspot Area Averaged Over Individual Solar Rotations



NASA

FIGURE 10
ISES Solar Cycle Sunspot Number Progression
(Observed Data Through July 2011)



counting these sunspots (**Figure 9**), and have recognized that it is a clear cycle. Yes, it starts from the high latitudes and heads down to the Equator, but the cycle itself lasts roughly 11 years, give or take, and you can see the actual sunspot count here: about 11 years. This last cycle was about 12 1/2 to 13 years.

Now, what we recognize with this cycle is that it actually does have a bearing on what happens on the Earth. For example, some have shown that when you have a minimum, very few sunspots—like this area here (bottom of Figure 9)—you have cold and cloudy weather. When you have a lot of sunspots, it tends to become hot and sunny. In fact, William Herschel, back in the mid-1700s-early 1800s, made the forecast that when you have fewer sunspots, your wheat becomes more expensive. This is a period where you have cloudier, colder days, so the wheat doesn't grow as well. And he actually made a correlation between the price of wheat and number of sunspots.

NOAA—the National Oceanic and Atmospheric Administration—keeps a record of the number of sunspots. It's part of their job. And they're measuring the number of sunspots going into this next cycle, and they're forecasting the peak will be about December 2012, early 2013. But if you look closer (**Figure 10**), it looks like this cycle is going to be weaker than the last cycle. In other words, there will be a total of less sunspots than the last cycle, probably fewer solar flares, a weaker Sun. So possibly, colder for the next few years.

Other Sense-Perceptions: The 'Rush to the Poles'

Now let's see what this looks like in other senses. We're going to look at several other sense-perceptions and how the current 11-year cycle is showing up.

First, we're going to look at this line which is Iron-14, which is 530.3 nanometers (nm), and it shows up very well in the outer portions of the Sun,

FIGURE 11a

Link here to animation.

FIGURE 11b

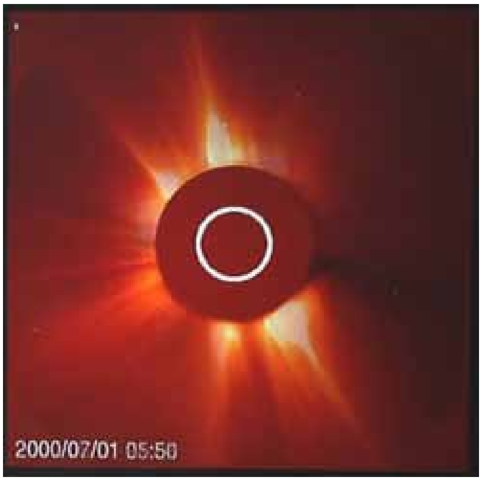


FIGURE 12

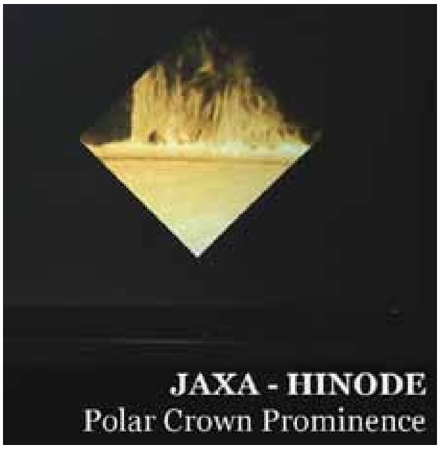
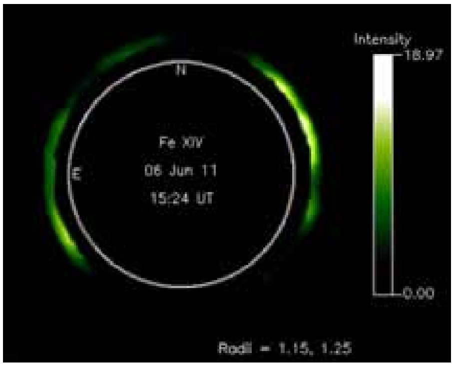


FIGURE 13



Iron-14 in the Sun's corona

the corona. You can see the corona here (**Figure 11a**). Here we've got the Sun blocked out. This is from the SOHO LASCO satellite. The Sun is blocked out by this disc, and all you can see is this material being flung off the limbs of the Sun, the corona.

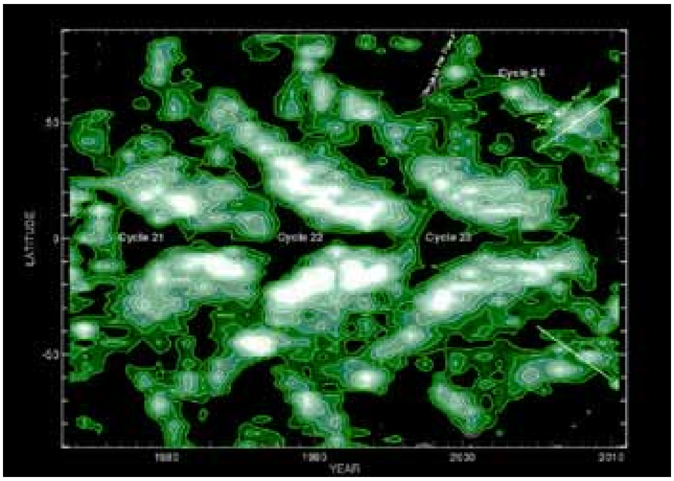
This series of videos of the Sun shows a specific type of corona which is located mainly off the Equator. If you look at a different period of the Sun, you see that sometimes the corona actually pops out of the poles, the so-called polar corona (**Figure 11b**). It tends to coincide with what are called polar crown prominences. This is a video taken by the Japanese Hinoda satellite (**Figure 12**), and you see the curtain of prominences that surface on the Sun up near the pole, which coincides with this polar-type corona.

Now, what we're going to look at is the observation of this 530.3-nm line, taken by Dr. Richard Altrock at the National Solar Observatory in New Mexico. What he looks at is a thin band of the corona at about 1.15 radii of the Sun. He uses a ground-based telescope and just looks at this ring around the Sun, and gets the intensity of this highly ionized iron.

He takes the corona, essentially straightens out the two sides of it (**Figure 13**), and then takes an average, to see over time, how does that average change? He takes the average, and then lines it up on a time axis (**Figure 14**), so that what you have is time going this way [to the right]; and then the vertical is how intense this iron line was at different latitudes of the Sun, specifically in the corona. And what you see is, it seems periodic. There's a migration down to the Equator, and the migration takes about 11 years. Very nice. It doesn't coincide exactly with the cycle of the sunspots that we see, but it's an 11-year cycle, so we believe that it's correlated very closely.

What Dr. Altrock is looking at specifically, is this feature up in the North, the polar crown prominences, which pop out a little bit before the

FIGURE 14



Dr. Richard Altrock, National Solar Observatory

FIGURE 15

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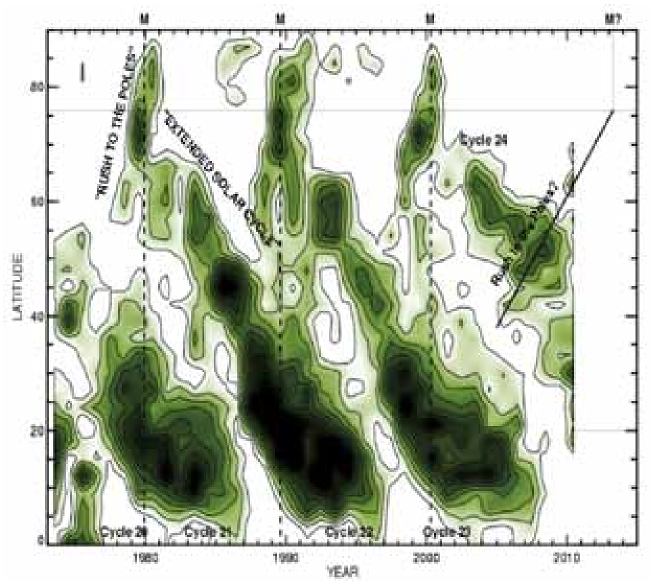
Polar crown prominences "rush to the poles."

FIGURE 16



Dr. Richard Altrock, National Solar Observatory

The rush to the poles in the current cycle (24) is running behind schedule.

maximum, and then take off towards the poles. Altrock calls this "the rush to the poles" (**Figure 15**); it was actually recognized decades ago, back in the 1930s and '40s.

In the current cycle, he notices something very interesting. Here's a closeup of the northern section (**Figure 16**). This is the rush to the poles back in the last solar cycle, so around 2000—and now the rush to the poles is just barely beginning, and he indicates that it's actually very late in the cycle. So, he suggests that the rush is beginning, but it's late. Therefore, he thinks that maybe the next cycle will actually come on a little bit later than the last one, so that the current solar cycle will probably be a little bit extra long, anomalously long. Interesting.

Torsional Oscillation

Now, let's look at another observation, with a completely different instrument. This is looking at a 676.8-nm line of nickel in the Sun. These observations were taken by Drs. Frank Hill, Rachel Howe, and their group at the Global Oscillations Network Group, called GONG, the headquarters of which are in Tucson, Arizona. They use a series of six boxes (**Figure 17**) distributed around the planet—one or two of these boxes are only looking at the Sun—so you can have 24/7 coverage of the Sun.

FIGURE 17

Global Oscillations Network Group (GONG)

Six boxes for observation, distributed around the planet, allow 24/7 coverage of the Sun.

What they are looking at specifically is not just where the line is, but how the line acts. Over time you see something like this: You see how this line is wiggling back and forth? What's happening is that the source of the line, where the nickel is on the Sun, is actually vibrating back and forth, towards and away from the observer, towards and away from the

FIGURE 18

The [Doppler shift] in observing the Sun

FIGURE 19

telescopes that we have in these boxes that the GONG group has set up around the planet.

And this wiggling back and forth of the surface of the Sun causes what's called the Doppler shift in the line. And so we measure that all around the Sun, and we get an image something like this (**Figure 18**). You can see, it looks something like a black and white Sun, a grayscale Sun, that's very finely rippled; it looks rough. You see that this part is actually darker than this side, because the dark represents parts of the Sun that are moving towards the observer. The light represents the parts of the Sun that are moving away. So there's a gray gradient going toward white in this direction. But if you look, the divets are dark and light, which represent the surface of the Sun that's just rippling. Here's a still (**Figure 19**). You can see, it's finely rippled.

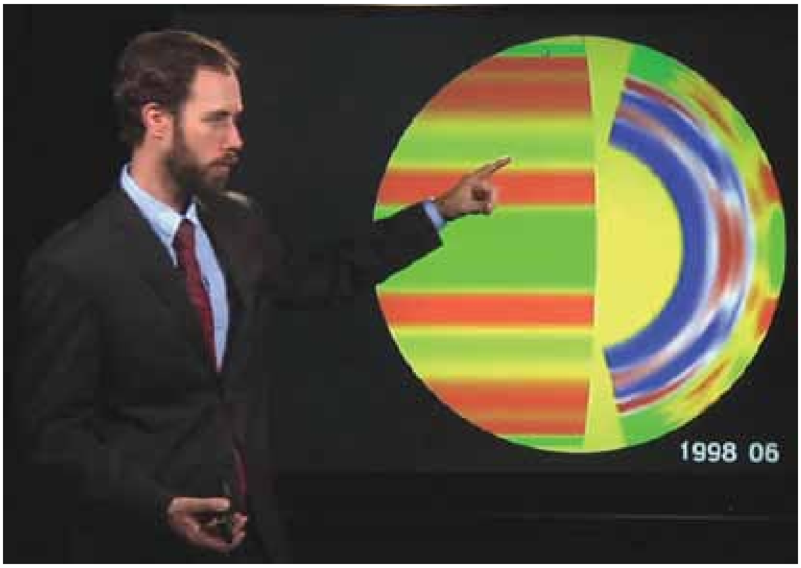
What they say is that these ripples of the surface represent millions of sound waves traveling through the interior fluid of the Sun. When they decompose all of these millions of tones, they can determine various changes which they believe are occurring very deep within the Sun, because they think that these waves are not merely traveling through the surface, but they're traveling through the deep interior of the Sun.

In fact, they believe that this is the only real way that we can get an idea of what's happening deep within the Sun. All of our other instruments can only see the surface and the corona of the Sun, and possibly a lit bit deeper into these sunspots. But this method, which is called helioseismology, they believe will tell us about something deep within the Sun.

One thing they recognized several years ago is what they called the torsional oscillation, which paints a picture of the Sun as an elastic body. Here's an animation they made of it (**Figures 20a-b**). What they found is that some bands of the Sun rotate faster than other bands of the Sun; so, it doesn't rotate as a solid body. Various parts rotate faster and slower. Here, the red is the faster-rotating Sun while the green and blue are slower-rotating. And if you look closely, there's a band in the North and one in the South, which migrate towards the Equator. And what they're showing here is that this occurs over an 11-year cycle. You see it now—these two bands starting at mid-latitudes, North and South, and then they migrate to the Equator.

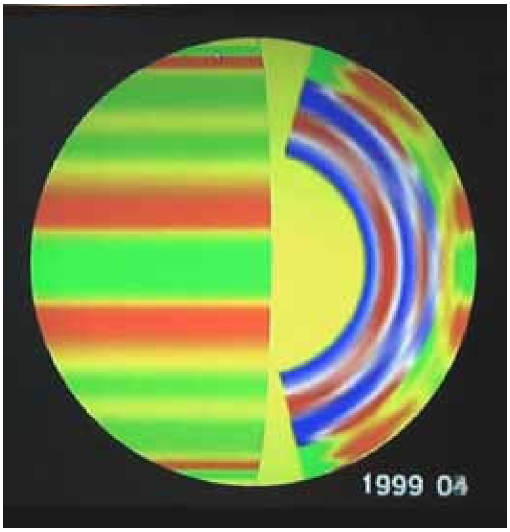
They say they've seen this several times, and it accurately mirrors the actual solar cycle, the actual sunspot cycle. They take this and make another plot, kind of like Altrock's plot, where here (**Figure 21**), on the hori-

FIGURE 20a



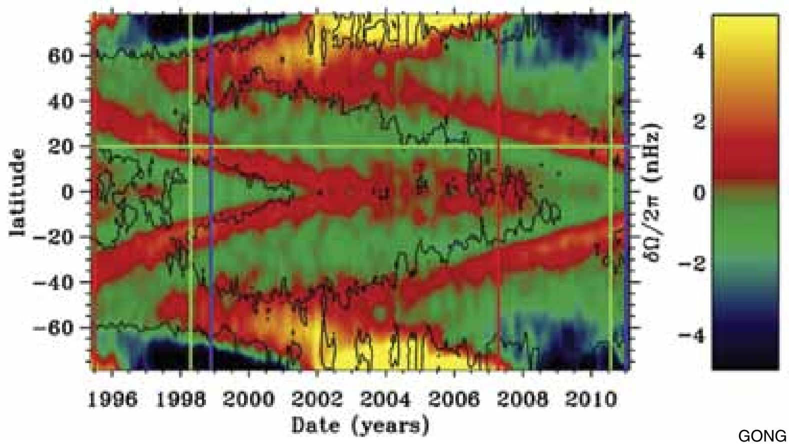
Link here to animation.

FIGURE 20b



GONG

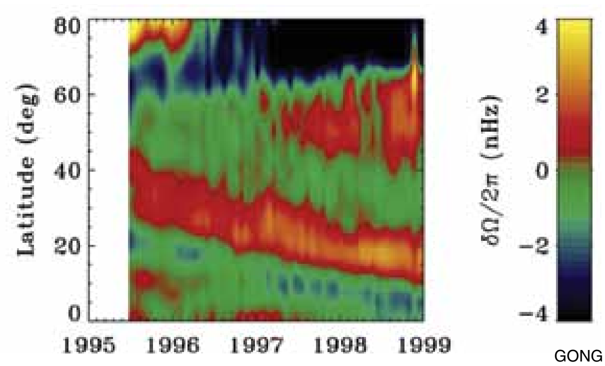
FIGURE 21



GONG

Different parts of the Sun rotate at different speeds.

FIGURE 22



GONG

zontal axis, you have time, and on the vertical you have the latitude of the Sun. So here's the Equator, here's the North Pole; here's the South Pole. Red means fast-rotating, green and blue mean slow-rotating.

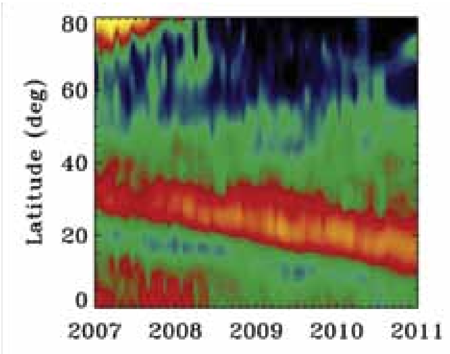
So you can see, at any one time—like the year 2000—you can see that the very, very south latitude of the Sun is rotating very quickly, and then the mid-latitude of the Sun is rotating very quickly, and it's mirrored in the Northern Hemisphere.

The black contour represents where we see the sunspots on the Sun through the cycle. So you see, here was the beginning of Cycle 23; here is the end of the Cycle 23. You can see that there's actually a very long solar minimum after 2008, compared to this solar minimum, which is relatively short before Solar Cycle 23.

They show on this graph that this torsional oscillation begins at the North and South, and then begins to migrate toward the Equator. One ends in the middle of the progression of another one. Now, if you look about 11 or 12 years ago, you see something like this (**Figure 22**): Back in '96, '97, the torsional oscillation was at about 20-25°, and you had the beginning of the torsional oscillation of the current cycle, at about the same time, in higher latitudes. They can see this with these oscillations.

If you compare this with where we are today, which should be at around the same spot, because we're at the

FIGURE 23



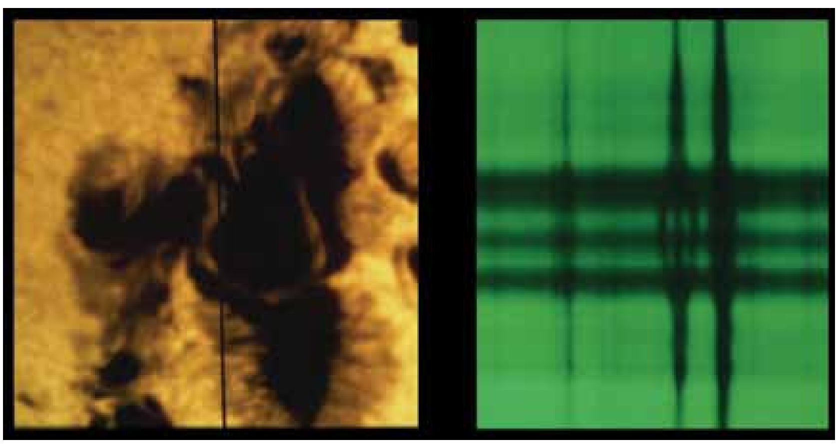
GONG

same position in the current solar cycle that we were in Cycle 23, which you can see with the location of this band, you see something very alarming (**Figure 23**). The torsional oscillation has not appeared yet for the next cycle. Very strange! Hill and Howe, and also Altrock, combine their observations, and they propose that the next cycle—because of these two observations, the very late rush to the poles and the absent torsional oscillation—will probably come on very late, and possibly be quite weak.

The Photosphere

Now we're going to look at a third wavelength band. This one is going to look directly at the surface of the Sun, the so-called photosphere, and it's not anywhere in the visible range. It's out here, in the infrared. This is the 1,564.8-nm line, and it's being observed by Matthew Penn and Bill Livingston at the McMath-Pierce Solar Telescope, which is quite an amazing piece of technology. It's the so-called "upside-down checkmark telescope." It's a long tube drilled into the ground, which has kept the same temperature as the ambient temperature in Tucson, at Kitt Peak, and it's the most powerful solar telescope we have on the ground. They're using this in order to look at how this line acts—specifically this iron line; this is a neutral iron—how it functions inside of a sunspot.

FIGURE 24



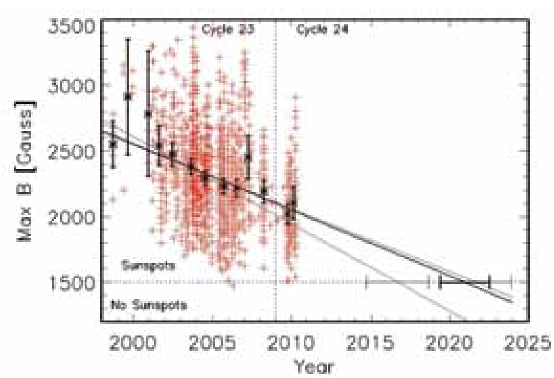
NSO/AURA/NSF

The Zeeman split in the spectral lines of iron in a sunspot (left) is shown on the right, where the one line spreads into three.

It was discovered early in the 1900s, that when you take an element, force it to display its spectrum, and then put it within a strong magnetic field, each of the spectral lines will split, and the split is proportional to how strong the magnetic field is. This is called the Zeeman split.

Now, Penn and Livingston are looking at how the iron lines split inside of the sunspots (**Figure 24**), and as we can see, the lines split very much within a sunspot. This is the spectrum at this part of this image; this is the spectrum within the sunspot; and this is the spectrum below the sunspot, along this line. What we find is that, within the sunspot, that's where you have the strongest magnetic field, because you have the split.

FIGURE 25

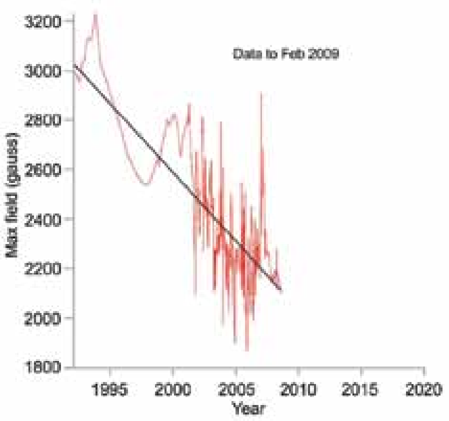


Matthew Penn and Bill Livingston

The magnetic field is measured in gauss, and it's usually several thousand gauss within the sunspots. What Penn and Livingston show—they've been looking at this for the past decade and a half or so, and looking at the spectrum in every single Sunspot—is that the Zeeman split is getting weaker and weaker on average, every year (**Figure 25**). They indicate that, first of all, no sunspot displays a magnetic field that's weaker than 1,500 gauss. That's the cutoff here.

But then they also show that, on average, every year the average strength of magnetic field within the sunspots is dropping by

FIGURE 26



Matthew Penn and Bill Livingston

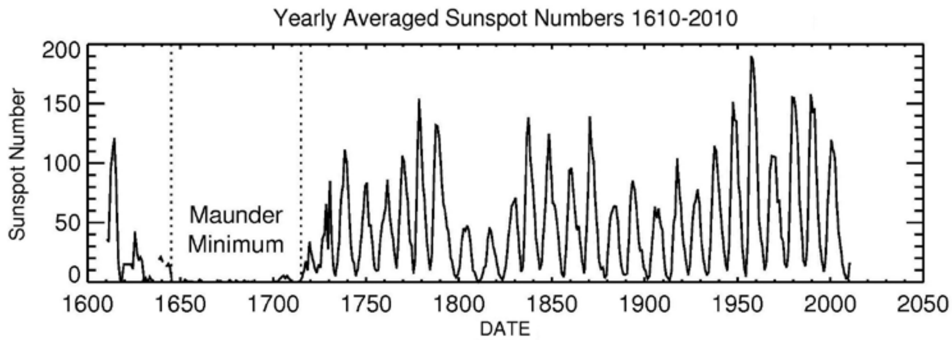
50 gauss. Their recent paper, which was put out last year, indicates that if this drop continues linearly, and we have every indication that it's headed in this direction, by about 2015-20, the Sun's magnetic field will be too weak to produce sunspots (**Figure 26**).

What do we get when we combine these three observations? Three completely different instruments, three completely different bands of radiation; therefore, three completely different senses. When you combine the observations, you get what the American Astronomical Society forecast back on June 15, 2011: The current sunspot cycle, cycle number 23, may be the last sunspot cycle for several decades.

The Little Ice Age

The last time we saw this was a long time ago. If you go back to the entirety of measurements of sunspots over the history of the world (**Figure 27**), the earliest observations were back in about 1610-15, by collaborators of Johannes Kepler, the same man who invented the telescope. His collaborators were the first to measure the numbers of sunspots on the Sun. And what you find, if you reconstruct the counts, is that between about 1645-1715, there are almost no sunspots. And this wasn't because people stopped counting sunspots; it's because very few sunspots were actually observed.

FIGURE 27



NASA

It begins again about 1715, and takes off—you have a little dip here and there, like the so-called Dalton Minimum, etc. Long-term cycles. In about the 1950s, you have the highest yet; and then we're going into the current cycle.

FIGURE 28

Wikimedia Commons

"The Frozen Thames," 1677, artist unknown.

But this period, where there were no sunspots, which is indicated by these three recent observations—this period coincided in Europe with what's called the Little Ice Age, which was one of the coldest periods on record in Europe. This was the time when birds were freezing as they flew through the air and plummeted to the ground. This is the period where you have paintings of the Thames River, and other rivers, frozen solid (**Figure 28**). You have these stories of people setting up little roads and shops on the Thames in order to kind of have fun with the fact that it was so cold, until it got *so* cold that people started dying of the cold, and the food started to freeze.

Now, all indications are that we're headed into another period just like that. This will be the first complete observation of one of these long cycles on the Sun.

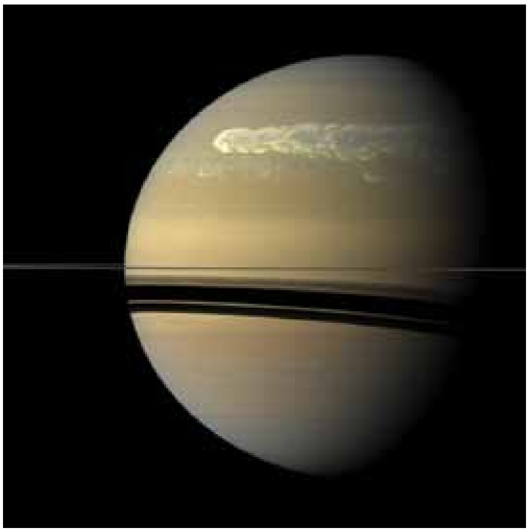
Now, let's step back for a moment. The Sun has been around for a long time. It's been around for at least as long as life has existed on the Earth! By all current estimates, the Sun is about 5-6 billion years old. This Sun has been with us through all the mass extinctions of organisms, such as the extinction of the dinosaurs, the extinction after the Permian, which wiped out 98% of the organisms on the planet. This Sun has been with us through this whole time; and if you look at the fact that there's an apparent cyclicity, a cycle of mass extinctions on the Earth, of about 62 to 65 million years, we should assume that the Sun also has much, much longer cycles, that perhaps coincided with these extinctions.

Now, we don't know what's in the Sun, or what's creating the cycles that we observe or hypothesize exist. We've only done real observations of the Sun for, if you really go back to the Greeks and Egyptians, for maybe 2-3,000 years, and we've been keeping detailed observations of features on the Sun for only about 350 years. So we don't know what's driving the cycles within the Sun. But we can make forecasts based on juxtaposing contradictory sense-perceptions and then using our creativity to make these forecasts. We can then act on these forecasts, and change the behavior of the human species accordingly.

Doesn't this mean that, if we prepare now, we can save the human race from extinctions such as what wiped out the dinosaurs? Doesn't that make us an immortal species? Doesn't that make it possible that we could preserve the existence of the human race and the other species that we take along with us, indefinitely?

If you look at this another way, if you are the substance which develops those insights which are commensurate with the creative substance of the universe, doesn't that make you exactly what is *not* sense-perceived? Yes, man inhabits a mortal body, but our true substance is the same as that of the universe, and it's there that the true immortality of the creative individual resides.

FIGURE 29



NASA/Cassini

A storm in Saturn's Northern Hemisphere

Saturn's Weather

Okay, after all that, let's take some time to actually look at some of the recent weather—on Saturn. Around December of last year, we noticed a feature pop up on Saturn called the Northern Storm. It's a huge storm, and we began observing it with various telescopes on the Earth, and also began taking snapshots of it with the Cassini satellite, which is orbiting it (**Figure 29**). By about February of this year, you can see that the storm actually wraps all the way around Saturn.

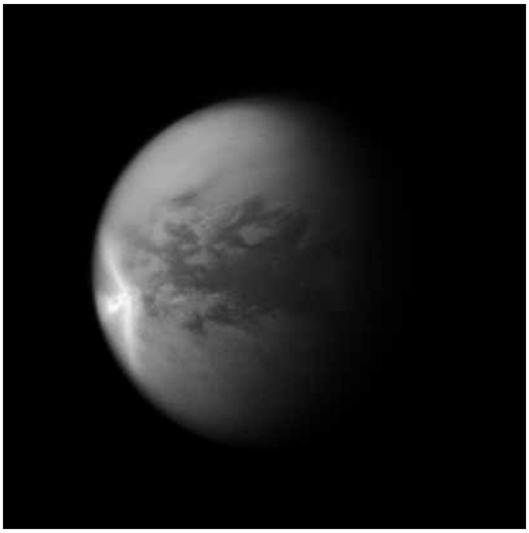
This is the tail of the storm, coming around from the other side. This is a close-up of the core of the storm (**Figure 30**). This thing is rippling with activity. We actually have recordings online of an almost constant hum of large thunder and lightning occurring in this storm on Saturn, which might remind some people of the electrical storm we had on the Mid-Atlantic coast over the past few days.

FIGURE 30

NASA/Cassini

Closeup of the storm

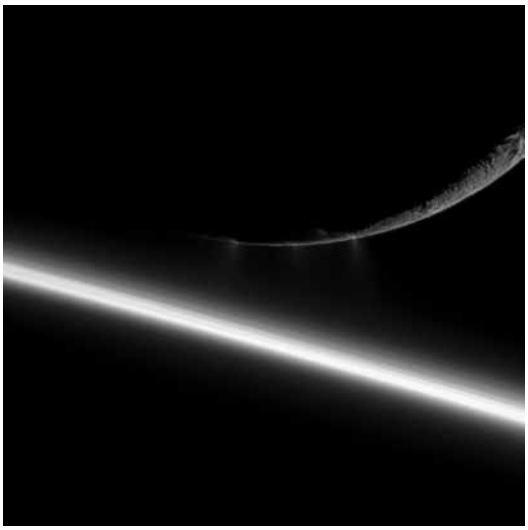
FIGURE 31



ASA/Cassini

A storm on Titan, one of Saturn's moons

FIGURE 32



NASA/Cassini

Jets shooting out from Enceladus, one of Saturn's moons

If you look at this storm, if you unwrap this northern latitude of Saturn, the storm is going all around the planet. If you look at it a couple of hours later, you see that the storm changes rapidly. And mind you, this storm is about the radius of the Earth! It's absolutely gigantic, and it's changing at a very rapid pace.

Now, weather's not just occurring on Saturn. This is the first time we've seen a storm of this magnitude. We've seen other storms, but this is the largest that we've seen.

Let's look at the moon Titan, which is the largest moon of Saturn, probably the one body in the Solar System that's most like Earth. Right now, Titan is beginning to experience storms, as is seen in this very strangely shaped storm cloud (**Figure 31**). To all our knowledge, it's right now raining on Titan. This is the beginning of its rainy season—but it's not raining water. It's raining methane.

If you look at another moon of Saturn, Enceladus, the whitest body in the Solar System, you see that it's pumping out jets from its South Pole (**Figure 32**). These are the so-called south polar jets, and this image was just taken several days ago. So you're having weather, not just on Saturn, but also on the moons of Saturn. The whole Saturn system is beginning to explode.

Now, we've seen large storms on Saturn before, although this one is the largest one that we've seen. The last several times that we've seen these storms was right after Saturn's Summer Solstice. Saturn is also inclined in its orbit, like the Earth, so it experiences seasons just like the Earth does, although the seasons take about 30 years to complete. So it's about 7-9 years beween seasons.

The last time we saw storms like this was after the Summer solstices. But this storm is happening way too early right now. We just passed the Spring Equinox, the Vernal Equinox on Saturn. The Summer Solstice isn't really supposed to happen until 2017, so right now we really don't know what's causing the weather in the Saturn system. Nobody knows what's causing the weather in the Saturn system. Maybe the Sun has something to say about this?

This has been your Weather Report. Thanks for joining me today.

Background Information

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